DTP Immunization Status and Tetanus Antitoxin Titers of Mexican American Children Ages Six Months through Eleven Years

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Abstract: Data from the Mexican American portion of the Hispanic Health and Nutrition Examination Survey (HHANES), conducted in 1982–83, were analyzed for the number of diphtheria, tetanus, and pertussis (DTP) immunizations reported for Mexican American children 6 months–11 years of age and for levels of tetanus antitoxin titers in Mexican American children 4–11 years of age. In Mexican American children 6 months–11 years, 98.2 per cent had one or more DTP immunizations reported (95 per cent CI: 97.5, 98.9%); 85.1 per cent had three or more DTP immunizations reported (95 per cent CI: 83.2, 87.0%). The reported immunization coverage in Mexican American children was corroborated by the tetanus antitoxin titers which were above the minimum protective level (≥0.01 IU/ml) in 99.6 per cent of the 4–11 year olds. Using the American Academy of Pediatrics' (AAP) recommendations for the number of DTP immunizations, 61.1 per cent of the children 6 months–11 years of age had the age-appropriate number of immunizations (95 per cent CI: 58.5, 63.7%). AAP immunization completion rates were higher for children who: had a source of care reported (62.1 vs 44.3%; 95% CI of the difference: 7.1, 28.5); had insurance coverage (63.5 vs 56.1%; 95% CI of the difference: 2, 12.8); lived in a standard metropolitan statistical area (SMSA)-not central city as compared to SMSA-central city or not SMSA (66.6 vs 57.1%; 95% CI of the difference: 4.3, 14.7); and had 12 or more completed years of education for the head of the household (65.4 vs 58.3%; 95% CI of the difference: 1.8, 12.4). These four predictors were used to identify subgroups within the Mexican American population at high risk for incomplete immunization status. (*Am J Public Health* 1988; 78:1446–1450.)

Introduction

The health status and use of health care services by the Hispanic population in the United States have been questioned, because of the language barrier faced by many Hispanics and their lower income and education levels, relative to the general population.[1,2] To help clarify these issues, the National Center for Health Statistics (NCHS) conducted the Hispanic Health and Nutrition Examination Survey (HHANES) to assess some aspects of the health and nutritional status of the Hispanic population in selected areas of the United States.

In the HHANES, one surrogate measure of health care use was reported diphtheria, tetanus, and pertussis immunizations (DTP) and tetanus serology. DTP shots are given in connection with routine preventive care and thus reflect use of health care services. DTP immunizations, along with other childhood immunizations, have been identified as a 1990 Health Objective for the Nation.[3] Data from HHANES provide the first information on the attainment of this objective by Mexican-American children.

This paper focuses on the number of DTP shots reported in the Mexican American portion of the Hispanic Health and Nutrition Examination Survey (HHANES) for children 6 months–11 years of age and tetanus titer levels among children 4–11 years of age.

Methods

HHANES Survey Design

The HHANES was conducted among three Hispanic subgroups from July 1982 through December 1984 in three target areas of the United States: Mexican Americans in five southwestern states, Puerto Ricans in the New York City area, and Cuban Americans in Dade County (Miami), Florida.[4] The sample design of HHANES was a stratified, multistage, probability sample of persons 6 months through 74 years of age. Only data from the Mexican American portion of the survey are presented in this report.

The Mexican American portion of HHANES was conducted among civilian, noninstitutionalized persons of Mexican origin in parts of five southwestern states (Arizona, California, Colorado, New Mexico, Texas). The sample of 14 primary sampling units (PSUs), counties or small groups of counties, included 9,894 sample persons of whom 7,462 (75 per cent) were interviewed and examined. The weighted estimates presented in this report are representative of Mexican Americans in these five southwestern states. The weights for each survey participants included adjustments for nonresponse and noncoverage of geographic areas.

There were two levels of noncoverage of the Hispanic population in the southwest HHANES: 1) noncoverage of the Mexican American population residing in excluded counties in the Southwest with a small number and/or per cent of Mexican American residents (about 3 per cent); and 2) noncoverage of the Mexican American population residing in excluded census block groups or enumeration districts with small numbers of eligible Hispanics within the sample PSUs (about 10 per cent). Given the above two levels of noncoverage, the net coverage rate of the 1980 Mexican origin population in the Southwest was approximately 87 per cent.[4]

The sample weights were also post-stratified to Mexican American population totals for the Southwest as estimated by the US Bureau of the Census at the midpoint of the Mexican American portion of HHANES, i.e., March 1, 1983. Details of the HHANES sample design, selection process, operational plan, quality control procedures, and questionnaires have been previously documented.[4]

Data Collection

The HHANES included both a household interview and a three-hour medical examination conducted in a specially designed mobile examination center (MEC). During the household interview, information on children less than 12 years of age was obtained from the parents or other respon-

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TABLE 1—Percentage of Mexican American Children 6 Months–11 Years of Age with Reported Diphtheria, Tetanus, and Pertussis Immunizations

Age (yrs)	Sample Size	Population Estimate (in 000's)	One or more DTP Immunizations	Three or more DTP Immunizations	AAP Recommendations for DTP Immunizations[a]
0.5–11	2,562	2,221	98.2 (97.5,98.9)	85.1 (83.2,87.0)	61.1 (58.5,63.7)
0.5–1	364	329	95.3 (92.3,98.3)	65.8 (59.0,72.6)	65.8 (59.0,72.6)
2–6	1,152	997	98.1 (97.0,99.2)	85.4 (82.6,88.2)	61.3 (57.5,65.1)
7–11	1,046	895	99.5 (98.9,100*)	91.7 (89.4,94.0)	59.1 (55.0,63.1)

a) American Academy of Pediatrics recommendations:
0.5–1 year—at least 3 DTP immmunizations;
2–6 years—at least 4 DTP immunizations;
7–11 years—at least 5 DTP immunizations;
( ) = 95% Confidence Interval
* = Rounding.
SOURCE: NCHS, HHANES, 1982–83

sible adult household member. Upon completion of the household interview, participants were scheduled for an examination that included tetanus antitoxin titers for children 4 through 11 years of age.

Study Population

A total of 3,000 children 6 months–11 years of age were selected for the Mexican American portion of HHANES; 85.4 per cent completed the immunization section of the household interview; 78.5 per cent participated in the examination.

In the 4–11 year age group, 2,027 children were selected for the survey: 84.7 per cent completed the immunization section of the interview; 78.2 per cent participated in the examination. Tetanus titers were measured in 70.6 per cent of the examined children 4–11 years of age. Failure to obtain an adequate blood specimen was the primary reason for not performing the tetanus titer assay. The children having tetanus antitoxin titers measured were slightly older than the interview and examination sample (mean age 7.9 versus 7.5 years); they did not differ, however, on any of the other variables used in this study.

Variables

Tetanus antitoxin titers were determined by the Immunology Laboratory of the Division of Bacterial Diseases, Center for Infectious Disease, Centers for Disease Control, using the hemagglutination assay method[5] as part of a collaborative project with the Division of Maternal and Child Health, Health Resources and Services Administration, and NCHS. A protective level of tetanus antitoxin titer was considered to be 0.01 IU/ml or greater.[6,7]

Age was reported as year of age at last birthday. Immunization histories were obtained by recall during the household interview; the protocol did not require verification of responses by the participant's shot record. A child was considered to be up-to-date on immunizations if he/she had received the number of DTP shots recommended by the American Academy of Pediatrics (AAP): 6 months–1 year, at least three DTP shots; 2–6 years, at least four DTP shots; 7–11 years, at least five DTP shots.[8]

Source of care referred to the reporting of a usual place where routine health care or treatment of illnesses was received.

The poverty-income ratio (PIR) was calculated by dividing the total household income by the poverty threshold for a household of that size. The poverty thresholds, published by the Census Bureau,[9,10] are based on the total income needed to maintain a household on a nutritionally adequate food plan. Of the 2,562 in the study population, 194 were missing data on the PIR and were excluded from the analyses of PIR.

Education was defined by the completed years of education for the head of the household. Of the 2,562 in the study population, 138 were missing data on education and were excluded from the analyses of education.

Residence was originally categorized in three ways: standard metropolitan statistical area (SMSA)-central city, SMSA-not central city, and not SMSA. Preliminary analyses found the rate of immunizations similar between SMSA-central city (57 per cent) and not SMSA (57.5 per cent). As a result, these two categories were collapsed in further analyses.

Statistical Analysis

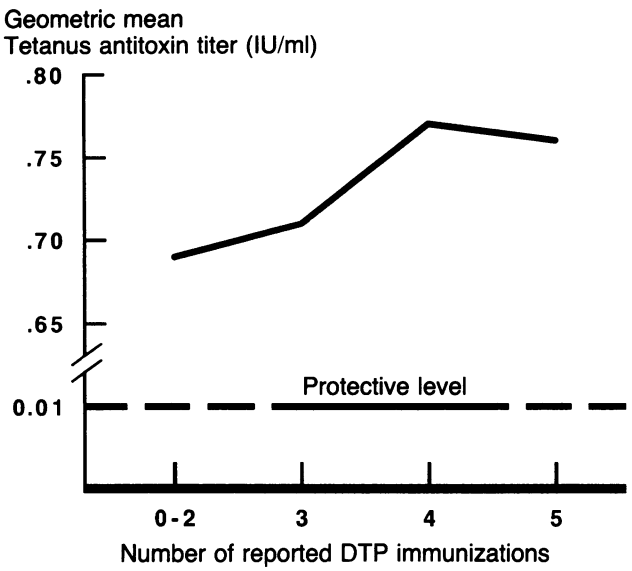
Sampling weights were used when calculating point estimates in order to account for individual selection probabilities and adjustments for non-response, non-coverage, and post-stratification which resulted from the complex survey design used in HHANES.

The complex survey design used in the HHANES tended to increase the variances which would have been obtained through simple random sampling.[11] The complex survey design was accounted for by using an average design effect to adjust the variances calculated under the assumption of simple random sampling. As described by Kovar,[12] the design effect is the ratio of the variance of a statistic from a complex sample to the variance of the same statistic from a simple random sample of the same size. The value of the design effect serves as an indication of the impact of the complex sample design on the variance. The average design effect for immunization status was 1.85. A t-test was used to compare point estimates and a linear test for trend was made using an orthogonal contrast.[13] All data analyses were done using programs accessible through SAS.[14]

Results

In Mexican American children 6 months–11 years of age, 98.2 per cent had one or more DTP immunizations reported (95% CI: 97.5, 98.9%); 85.1 per cent had three or more DTP immunizations reported (95% CI: 83.2, 87.0%) (Table 1).

This high level of reported immunizations is supported by the tetanus antitoxin titers of Mexican American children 4–11 years of age (Figure 1). Overall 99.6 per cent of Mexican American children had tetanus antitoxin titers above the



SOURCE: NCHS, HHANES, (MA), 1982-83

FIGURE 1—Tetanus Immunity Status of Mexican American Children four years through 11 years of age

minimal protective level of 0.01 IU/ml regardless of the number of DTP shots reported. A slight but unimportant increase in tetanus titers was noted with an increasing number of reported DTP shots. In the 4–11 year age group, 99.3 per cent had one or more DTP immunizations.

In the HHANES, using the AAP recommendations, as defined earlier, a more pessimistic picture emerges; 61.1 per cent of Mexican American children 6 months–11 years of age had up-to-date immunization coverage (95% CI: 58.5, 63.7%) (Table 1).

The association between various sample person characteristics and reported up-to-date immunization status according to AAP standards is shown in Table 2. Higher levels of up-to-date immunization coverage were found among children having a source of care reported, having health insurance coverage, living in a SMSA-not central city as compared with SMSA-central city or not SMSA, and with 12 or more completed years of education for the head of household. Higher levels of reported up-to-date immunization coverage were found in children living at or above the poverty level and those in families of four or fewer persons, however, these differences included 0 in the 95 per cent confidence interval of the difference. Little variation in up-to-date immunization coverage by sex was noted.

Four predictors of up-to-date immunization coverage were found in this study (source of care, health insurance, residence in a SMSA-not central city, and 12 or more completed years of education for the head of the household). These four variables were tested to see if they could be used to identify a segment of the population at high risk for incomplete immunization status (Table 3). When 0–1 predictors were present nearly 50 per cent of the children had incomplete immunization coverage. But when all four predictors of up-to-date immunization coverage were present, the percentage of children reporting incomplete immunization coverage dropped to 28.3 per cent.

Discussion

Virtually all 6 months–11 year old Mexican American children had at least one DTP immunization. The high level of immunization coverage found in HHANES may reflect the efforts directed at increasing immunization levels beginning with the 1977 US Initiative on Childhood Immunization.[15] As a result of this Initiative, all 50 states now have requirements for immunization at the time of entry to school.[16] All children in HHANES 6–11 years of age reported school attendance.

The tetanus antitoxin titers measured on 4–11 years old Mexican American children corroborated the high level of reported immunizations. The tetanus antitoxin titers reflect past tetanus immunization, since naturally acquired immunity to tetanus is virtually nonexistent in the United States, and the disease state itself does not confer immunity.[17]

Certain subgroups of Mexican American children, such as children of migrant workers, however, may not have been well covered in the survey. The rate of immunization may be lower for these subgroups than for those reported in the total Mexican American population.

The 1990 Objective for the Nation on Immunization Status sets as its goal at least 90 per cent of two-year-old children with their basic immunization series complete.[3] In Mexican American children 2 years of age, 76.4 per cent had received three or more DTP shots. Thus, in regard to DTP immunizations, Mexican American children in the Southwest are short of the 1990 Objective.

Data on childhood immunization levels were not collected in previous Health Examination Surveys. The only national data on immunization levels for a comparable time period are from the 1982 United States Immunization Survey (USIS), a supplement to the Current Population Survey.[18,19] These data, however, are not strictly comparable to the HHANES because of differences in survey methodology. Also, the USIS was a subsection of a survey dealing with labor force participation and not a health survey as HHANES was.

The data collected in the USIS was for two groups: the total sample and the record sample, a subgroup claiming to have based its reported immunization history on a shot record. The record sample was approximately 33 per cent of the total sample. The record sample was found to be more consistent with the state data.[20,21] The accuracy of the immunization levels reported in the USIS have been verified by comparing the results to state reports on immunization status of children entering school.

Comparison of the data from the USIS[22] with comparable age groups in the HHANES revealed somewhat confusing results. In the 1–4 year age group, 78.6 per cent of Mexican American children in HHANES had three or more DTP immunizations. In the 1982 USIS total sample, 70.6 per cent of White children and 48.4 per cent of children of Other Races had three or more DTP immunizations and in the 1982 USIS record sample 88.4 per cent of White children and 74.6 per cent of children of Other Races had three or more DTP immunizations. In the 5–9 year age group, 92.1 per cent of Mexican American children in HHANES had three or more DTP immunizations, while in the 1982 USIS total sample 79.3 per cent of White children and 63.4 per cent of children of Other Races had three or more DTP immunizations. In the 1982 USIS record sample, 95.1 per cent of White children and 87.0 per cent of children of Other Races had three or more immunizations.

Thus, in regard to DTP immunization status, the relative position of Mexican American children, based on HHANES data, in comparison to White children in the 1982 USIS changes depending on which sample is used. However, the

TABLE 2—Per Cent of Mexican American Children 6 Months–11 Years of Age with Reported Up-to-date Diphtheria, Tetanus, and Pertussis Immunizations[a] by Selected Characteristics

Characteristics	Size of Study Population	Population Estimate (in 000's)	Per Cent Immunized	95% Confidence Interval of the Difference
Total	2,562	2,221	61.1 (1.31)	
Reported Source of care				
Yes	2,404	2,090	62.1 (1.35)	
No	158	131	44.3 (5.28)	7.1, 28.5
Health Insurance				
Yes	1,700	1,495	63.5 (1.60)	
No	862	726	56.1 (2.27)	2.0, 12.8
Residence				
SMSA-not central city	1,048	926	66.6 (2.00)	
SMSA-central city or not SMSA	1,514	1,295	57.1 (1.71)	4.3, 14.7
Completed years of education for the head of the household[b]				
12+	1,014	919	65.4 (2.08)	
0–11	1,410	1,184	58.3 (1.75)	1.8, 12.4
Poverty Index Ratio (PIR)[b]				
At/Above PIR	1,490	1,324	62.5 (1.73)	
Below PIR	878	738	57.0 (2.23)	−0.03, 11
Number of persons in family				
2–4	1,077	966	63.4 (2.03)	
5–18	1,485	1,255	59.3 91.71)	−1.1, 9.3
Sex				
Male	1,279	1,117	60.2 (1.86)	
Female	1,283	1,104	62.0 (1.84)	−3.4, 6.9

a) American Academy of Pediatrics recommendation
b) Of the 2,562 in the study population, 194 were missing data on PIR and 138 were missing data on education. These individuals were excluded from the analyses for these respective variables.
( ) = Standard error
SOURCE: NCHS, HHANES, 1982–83

TABLE 3—Predictors[a] of Reported Up-to-date Immunization Coverage[b] in Mexican-American children 6 months through 11 years of age

Presence of Predictors of Up-to-Date Immunization Coverage	Size of study population[c]	Population Estimate (in 000's)	Per Cent with Incomplete Immunization Coverage
0–1 Predictors	447	379	49.4 (3.18)
2 Predictors	773	638	41.0 (2.35)
3 Predictors	839	740	35.8 (2.27)
4 Predictors	365	347	28.3 (3.36)*

a) Predictors of up-to-date immunization coverage: Source of care, health insurance, residence in an SMSA—not a central city, 12 or more completed years of education for the head of household.
b) American Academy of Pediatrics recommendations.
c) Of the 2,562 in the study population, 138 were missing data on education. These individuals were excluded from this analysis.
* = Test for trend $p<0.01$.
( ) = Standard error.
SOURCE: NCHS, HHANES, 1982–83.

relative positive of Mexican American children in comparison to children of Other Races does not vary between the two samples.

Examining the percentage of Mexican American children with reported up-to-date immunization coverage according to the AAP recommendations reveals a more pessimistic picture. Only 61.1 per cent of Mexican American children were considered up-to-date by these standards. However, with the addition of one more immunization, 79.8 per cent would be up-to-date and with the addition of two more immunizations, 93.0 per cent would be up-to-date. Thus, only two visits would be required to bring over 90 per cent of the children up-to-date on their immunizations.

The predictors of immunization coverage among Mexican American children in this study are similar to previously identified predictors: use or contact with the health care system,[23,25] socioeconomic status, e.g., income[26,27] and education[26–29]; residency in a certain area[26,27]; and family size.[26,27,29]

Identifying high-risk groups is the first step in the primary prevention of disease. In Table 3 the effectiveness of four predictors of immunization status are shown. These

predictors can be used by health care providers to identify Mexican American children at higher risk for incomplete immunization coverage.

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American Federation of Teachers to Participate in Immunization Awareness Program

The American Federation of Teachers (AFT) has joined with the national network of children's hospitals in efforts to arrest the decline in childhood vaccinations. As part of an immunization awareness program, the groups will disseminate information in inner-city areas that have low levels of immunization. Over the last decade, the immunization rates have declined among preschool children of immigrant, poor, and minority children, due primarily to the lack of knowledge in these populations regarding the value of vaccinations.

The program will provide information to parents so they understand how their children can be protected from the dangerous childhood diseases that can threaten unvaccinated children. Central to the effort is a new booklet, available in both Spanish and English, which was prepared through a grant from Lederle Laboratories. The booklet discusses the preventable diseases (polio, measles, mumps, rubella, pertussis, diphtheria, tetanus, and haemophilus type-B infections); tells parents where to get vaccines, how they are administered, possible side effects; and includes a checklist for keeping track of immunizations. The brochure also alerts parents to the availability of free vaccinations — encouraging families with financial hardship to contact the Children's Hospital National Medical Center in Washington, DC at (202) 879-4458 for more information.

Copies of the brochure can be obtained by sending a self-addressed, stamped envelope to AFT Order Department, 555 New Jersey Avenue, NW, Washington, DC 20001.